CLAIMS

What is claimed is:

1. A method of making an armature, comprising:

placing a commutator and a lamination stack on a armature shaft, the commutator having a commutator ring with a plurality of segments with slots between adjacent segments, the commutator ring having notches at axial inner ends of the slots, the notches filled with an electrically non-conductive material, each segment having a tang at an axial inner end;

attaching ends of coil windings wound in slots in the lamination stack to the tangs of the commutator segments;

placing the armature shaft, commutator and lamination stack in a mold having projections that extend between the tangs; and

molding plastic around at least portions of the armature shaft, commutator and coil windings, the projections and filled notches preventing plastic from flowing into the slots between the commutator segments.

2. The method of claim 1 wherein the slots extend axially part way into the notches.

3. The method of claim 1 wherein a core of the electrically non-conductive material is molded in the commutator ring with the non-conductive material filling the notches during molding, the core molded to have a cylindrical hole extending axially through its center.

4. The method of claim 3 wherein the electrically non-conductive material is phenolic.

5. A method of making an armature, comprising:

placing a stuffer type commutator and a lamination stack on a armature shaft, the commutator having a commutator ring with a plurality of segments with slots between adjacent segments, each segment having a wire receiving slot at an axial inner end of the commutator ring, the commutator ring having inserts of insulative material extending axially part way into the slots between the adjacent segments from the axial inner end of the commutator ring;

placing ends of coil windings wound in slots in the lamination stack to wire receiving slots of the commutator segments;

placing the armature shaft, commutator and lamination stack assembly in a mold that has a portion that fits around the commutator ring over the inserts; and

molding plastic around at least portions of the armature shaft, commutator and lamination stack, the portion of the mold that fits around the commutator ring over the inserts preventing the plastic from flowing into the slots between the commutator segments.

6. A coil structure for a dynamoelectric machine, comprising: a lamination stack having a plurality of slots in which magnet wires are wound forming coils and thermally conductive plastic molded around the magnet wires with at least a feature formed in the thermally conductive plastic to enhance heat transfer.

7. The apparatus of claim 6 wherein the feature includes fins.

8. The apparatus of claim 6 wherein the feature includes at least a portion of a surface of the thermally conductive plastic being textured.

9. The apparatus of claim 8 wherein the textured surface of the thermally conductive plastic is textured by a pattern formed when the thermally conductive plastic is molded.

10. The apparatus of claim 6 wherein the coil structure is a coil structure for an armature of an electric motor.

11. The apparatus of claim 6 wherein the coil structure is a coil structure for a stator of an electric motor.

12. The apparatus of claim 6 wherein the dynamoelectric machine is a generator.

13. The apparatus of claim 6 wherein the dynamoelectric machine is an alternator.

14. An armature for an electric motor, comprising: a shaft having a lamination stack thereon, the lamination stack having a plurality of slots in which magnet wires are wound forming coils, thermally conductive plastic molded at least partially around the magnet wires with at least a feature formed in the thermally conductive plastic to enhance heat transfer.

15. The apparatus of claim 14 and further including a fan affixed to at least one of the shaft and the lamination stack, the thermally conductive plastic molded around the shaft of the armature at ends of the lamination stack, the at least one feature formed in the plastic molded at a end of the lamination stack opposite an end of the lamination stack where the fan is affixed.

16. The apparatus of claim 15 wherein the at least one feature includes fins.

17. The apparatus of claim 15 wherein the fan is molded from the thermally conductive plastic when the thermally conductive plastic is molded at least partially around the magnet wires.

18. The apparatus of claim 15 wherein the at least one feature includes at least a portion of a surface of the thermally conductive plastic being textured.

19. The apparatus of claim 18 wherein the texture includes a pattern formed in the surface of the thermally conductive plastic when the thermally conductive plastic is molded.

20. The apparatus of claim 14 wherein the thermally conductive plastic is molded around the magnet wires in the slots in the lamination stack to cover the magnet wires in the slots and so that an outer surface of the plastic is recessed from an outer surface of the lamination stack.

21. An armature for an electric motor, comprising: a shaft having a lamination stack thereon, the lamination stack having a plurality of slots in which magnet wires are wound forming coils, thermally conductive plastic molded at least partially around the magnet wires to cover the magnet wires in the slots and so that an outer surface of the plastic is recessed from an outer surface of the lamination stack.

22. The apparatus of claim 21 and further including at least a feature formed in the thermally conductive plastic to enhance heat transfer.

23. The apparatus of claim 22 and further including a fan affixed to at least one of the shaft and the lamination stack, the thermally conductive plastic molded around the shaft of the armature at ends of the lamination stack, the at least one feature formed in the plastic molded at the end of the lamination stack opposite the end of the lamination stack where the fan is affixed.

24. The apparatus of claim 23 wherein the fan is molded from the thermally conductive plastic when the thermally conductive plastic is molded at least partially around the magnet wires.

25. The apparatus of claim 21 wherein the feature includes at least a portion of a surface of the thermally conductive plastic being textured.

26. The apparatus of claim 25 wherein the texture includes a pattern formed in the surface of the thermally conductive plastic when the thermally conductive plastic is molded.

27. An armature for an electric motor, comprising: a shaft having a lamination stack thereon, the lamination stack having a plurality of slots in which magnet wires are wound forming coils, thermally conductive plastic molded around the magnet wires and the shaft to encapsulate the magnet wires, the thermally conductive plastic molded to form a fan on one end of the shaft extending from an end of the lamination stack, the plastic molded around the magnet wires in the slots so that an outer surface of the plastic is recessed from an outer surface of the lamination stack forming recesses between teeth of the lamination stack.

28. The apparatus of claim 27 wherein at least one feature is formed in a surface of the thermally conductive plastic molded at an end of the lamination stack opposite the end of the lamination stack from which the end of the shaft having the fan extends.

29. The apparatus of claim 28 wherein the at least one feature includes fins.

30. The apparatus of claim 29 wherein the at least one feature includes at least a portion of the surface of the thermally conductive plastic being textured.

31. The apparatus of claim 30 wherein the surface of the thermally conductive plastic is textured with a pattern formed in it during the molding of the thermally conductive plastic.

32. A stator for an electric motor, comprising: a lamination stack having a plurality of slots in which magnet wires are wound forming coils, thermally conductive plastic molded at least partially around the magnet wires with at least one feature formed in the thermally conductive plastic to enhance heat transfer.

33. The apparatus of claim 32 wherein the at least one feature includes fins.

34. The apparatus of claim 32 wherein the at least one feature includes at least a portion of a surface of the thermally conductive plastic being textured.

35. The apparatus of claim 34 wherein the textured surface of the thermally conductive plastic is textured with a pattern formed in it during molding of the thermally conductive plastic.

36. A coil structure for a dynamoelectric machine, comprising: a lamination stack having a plurality of slots therein lined with slot liners made of thermally conductive plastic and magnet wires wound in the slots forming coils.

37. The apparatus of claim 36 wherein thermally conductive plastic is molded in the slots of the lamination stack to form the slot liners.

38. The apparatus of claim 37 wherein the coil structure is a coil structure for an armature of an electric motor.

39. The apparatus of claim 37 wherein the coil structure is a coil structure for a stator of an electric motor.

40. The apparatus of claim 37 wherein the dynamoelectric machine is an alternator.

41. The apparatus of claim 37 wherein the dynamoelectric machine is a generator.

42. An armature for an electric motor, comprising: a shaft having a lamination stack thereon, the lamination stack having a plurality of slots therein lined with slot liners made of thermally conductive plastic, magnet wires wound in the slots in the lamination stack forming coils, and a commutator affixed to one end of the shaft with ends of the magnet wires affixed to the commutator.

43. The apparatus of claim 42 wherein the thermally conductive plastic is molded in the slots in the lamination stack to form the slot liners.

44. The apparatus of claim 43 wherein the thermally conductive plastic is molded around the armature shaft at ends of the lamination stack to form end spiders.

45. A method of making an armature for an electric motor, comprising:

placing a lamination stack having a plurality of slots therein on a shaft;

lining the slots with slot liners made of thermally conductive plastic;

affixing a commutator to an end of the shaft;

winding magnet wires in the slots to form coils; and

affixing ends of the magnet wires to the commutator.

46. The method of claim 45 wherein the thermally conductive plastic is molded in the slots in the lamination stack to form the slot liners.

47. The method of claim 45 wherein the thermally conductive plastic is molded around the shaft at ends of the lamination stack to form end spiders.

48. A stator for an electric motor, comprising: a lamination stack having a plurality of slots therein lined with slot liners made of thermally conductive plastic and magnet wires wound in the slots forming coils.

49. The apparatus of claim 48 wherein the thermally conductive plastic is molded in the slots of the lamination stack to form the slot liners.

50. A method of making a stator for an electric motor comprising lining slots in a lamination stack with slot liners made of thermally conductive plastic and winding wire in the slots to form coils.

51. The method of claim 50 wherein thermally conductive plastic is molded in the slots of the lamination stack to form the slot liners.

52. An electric motor, comprising an armature and a stator, the armature having a lamination stack having a plurality of slots therein lined with slot liners made of thermally conductive plastic and wires wound in the slots forming coils.

53. The apparatus of claim 52 wherein the stator has a lamination stack having a plurality of slots therein lined with slot liners made of thermally conductive plastic and wires wound in the slots of the lamination stack of the stator forming coils.

54. The apparatus of claim 52 wherein thermally conductive plastic is molded in the slots of the lamination stack of the armature to form the slot liners lining the slots in the lamination stack of the armature.

55. The apparatus of claim 53 wherein thermally conductive plastic is molded in the slots of the lamination stack of the armature and in the slots of the lamination stack of the stator to form the slot liners lining the slots in the lamination stack of the armature and to form the slot liners lining the slots in the lamination stack of the stator.

56. An electric motor, comprising an armature and a stator, the stator having a lamination stack having a plurality of slots therein lined with slot liners made of thermally conductive plastic and wires wound in the slots of the lamination stack forming coils.

57. The apparatus of claim 56 wherein thermally conductive plastic is molded in the slots of the lamination stack to form the slot liners.

58. An armature for an electric motor, comprising: a shaft having a lamination stack thereon, the lamination stack having a plurality of slots in which magnet wires are wound forming coils, the magnet wires having a layer of heat activated adhesive thereon, and plastic molded around the magnet wires, the heat of the plastic as it is molded activating the heat activated adhesive on the magnet wires.

59. The apparatus of claim 58 wherein the plastic includes thermally conductive plastic.

60. The apparatus of claim 58 wherein the heat activated adhesive, upon activation, bonds the magnet wires of each coil together to form mechanically solid coils within the plastic.

61. The apparatus of claim 58 wherein the plastic is molded around the magnet wires at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

62. An armature for an electric motor, comprising: a shaft having a lamination stack thereon, the lamination stack having a plurality of slots in which magnet wires are wound forming coils, the magnet wires having a layer of heat activated adhesive thereon, and thermally conductive plastic molded around the magnet wires, the heat of the plastic as it is molded activating the heat activated adhesive on the magnet wires to bond the coils of magnet wires into mechanically solid coils within the plastic to reduce movement of the coils and improve thermal transfer of heat out of the magnet wires.

63. An electric motor, comprising:

a stator;

an armature received in the stator, the armature having a shaft and a lamination stack on the shaft, the lamination stack having a plurality of slots;

magnet wires wound in coils in slots of the lamination stack, the magnet wires having a coating of heat activated adhesive; and

plastic molded around the magnet wires with heat of the plastic activating the heat activated adhesive on the magnet wires during molding of the plastic to bond the magnet wires together.

64. The apparatus of claim 63 wherein the plastic includes thermally conductive plastic.

65. The apparatus of claim 64 wherein the heat activated adhesive, upon activation, bonds the coils of magnet wires into mechanically solid coils to reduce movement of the coils and to improve heat transfer out of the magnet wires.

66. The apparatus of claim 63 wherein the plastic is molded around the magnet wires at a pressure sufficient to deform individual magnet wires into polygonal shapes.

67. A method of forming an armature for an electric motor, comprising:

winding magnet wires having a coating of heat activated adhesive thereon in a plurality of slots in a lamination stack on a shaft to form coils; and

molding hot plastic around the magnet wires, the heat of the plastic as it is being molded activating the heat activated adhesive on the magnet wires to bond the magnet wires of each coil together.

68. The method of claim 67 wherein molding hot plastic around the magnet wires includes molding hot thermally conductive plastic around the magnet wires.

69. The method of claim 68 wherein molding hot plastic around the magnet wires activates the heat activated adhesive on the magnet wires to bond the magnet wires of each coil into a mechanically solid coil within the plastic to prevent movement of the coil and enhance heat transfer out of the magnet wires.

70. The method of claim 67 wherein molding hot plastic around the magnet wires includes molding the plastic at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

71. A stator for an electric motor, comprising a lamination stack having a plurality of slots in which magnet wires are wound forming coils, the magnet wires having a layer of heat activated adhesive thereon, and plastic molded around the magnet wires, the heat of the plastic as it is molded activating the heat activated adhesive on the magnet wires.

72. The apparatus of claim 71 wherein the plastic includes thermally conductive plastic.

73. The apparatus of claim 71 wherein the heat activated adhesive, upon activation, bonds the magnet wires of each coil together to form mechanically solid coils within the plastic.

74. The apparatus of claim 71 wherein the plastic is molded around the magnet wires at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

75. A stator for an electric motor, comprising: a lamination stack having a plurality of slots in which magnet wires are wound forming coils, the magnet wires having a layer of heat activated adhesive thereon, and thermally conductive plastic molded around the magnet wires, the heat of the plastic as it is molded activating the heat activated adhesive on the magnet wires to bond the coils of magnet wires into mechanically solid coils within the plastic to reduce movement of the coils and improve thermal transfer of heat out of the magnet wires.

76. An electric motor, comprising:

an armature;

a stator, the stator including a lamination stack having a plurality of slots;

magnet wires wound in coils in slots of the lamination stack of the stator, the magnet wires having a coating of heat activated adhesive; and

plastic molded around the magnet wires with heat of the plastic activating the heat activated adhesive on the magnet wires during molding of the plastic to bond the magnet wires together.

77. The apparatus of claim 76 wherein the plastic includes thermally conductive plastic.

78. The apparatus of claim 77 wherein the heat activated adhesive, upon activation, bonds the coils of the magnet wires into mechanically solid coils to reduce movement of the coils and to improve heat transfer out of the magnet wires.

79. The apparatus of claim 76 wherein the plastic is molded around the magnet wires at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

80. A method of forming a stator for an electric motor comprising:

winding magnet wires having a coating of heat activated adhesive thereon in a plurality of slots in a lamination stack to form coils; and

molding hot plastic around the magnet wires, the heat of the plastic as it is being molded activating the heat activated adhesive on the magnet wires to bond the magnet wires of each coil together.

81. The method of claim 80 wherein molding hot plastic around the magnet wires includes molding hot thermally conductive plastic around the magnet wires.

82. The method of claim 81 wherein molding hot plastic around the magnet wires activates the heat activated adhesive on the magnet wires to bond the magnet wires of each coil into a mechanically solid coil within the plastic to prevent movement of the coil and enhance heat transfer out of the magnet wires.

83. The method of claim 80 wherein molding hot plastic around the magnet wires including molding the plastic at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

84. A coil structure for a dynamoelectric machine, comprising: a lamination stack having a plurality of slots in which magnet wires are wound forming coils, the magnet wires having a layer of heat activated adhesive thereon, and plastic molded around the magnet wires, the heat of the plastic as it is molded activating the heat activated adhesive on the magnet wires.

85. The apparatus of claim 84 wherein the dynamoelectric machine is an electric motor.

86. The apparatus of claim 84 wherein the dynamoelectric machine is an alternator.

87. The apparatus of claim 84 wherein the dynamoelectric machine is a generator.

88. The apparatus of claim 84 wherein the plastic includes thermally conductive plastic.

89. The apparatus of claim 84 wherein the heat activated adhesive, upon activation, bonds the magnet wires of each coil together to form mechanically solid coils within the plastic.

90. The apparatus of claim 84 wherein the plastic is molded around the magnet wires at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

91. A method of forming a coil structure for a dynamoelectric machine, comprising:

winding magnet wires having a coating of heat activated adhesive thereon in a plurality of slots in a lamination stack on a shaft to form coils; and

molding hot plastic around the magnet wires, the heat of the hot plastic activating the heat activated adhesive on the magnet wires to bond the magnet wires of each coil together.

92. The method of claim 91 wherein molding hot plastic around the magnet wires includes molding hot thermally conductive plastic around the magnet wires.

93. The method of claim 92 wherein molding hot plastic around the magnet wires activates the heat activated adhesive on the magnet wires to bond the magnet wires of each coil into a mechanically solid coil within the plastic to reduce movement of the coil and enhance heat transfer out of the magnet wires.

94. The method of claim 91 wherein molding hot plastic around the magnet wires includes molding the plastic at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

95. The method of claim 91 wherein the dynamoelectric machine is an electric motor.

96. The method of claim 91 wherein the dynamoelectric machine is an alternator.

97. The method of claim 91 wherein the dynamoelectric machine is a generator.

98. A coil structure for a dynamoelectric machine, comprising: a lamination stack having a plurality of slots in which magnet wires are wound forming coils and thermally conductive plastic molded around the magnet wires at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

99. The apparatus of claim 98 wherein the at least partial deformation of individual magnet wires into at least partial polygonal shapes increases surface area contact between individual magnet wires to enhance heat transfer from the magnet wires to the thermally conductive plastic.

100. The apparatus of claim 99 wherein the dynamoelectric machine is an electric motor.

101. The apparatus of claim 100 wherein the coil structure is a coil structure for an armature.

102. The apparatus of claim 100 wherein the coil structure is a coil structure for a stator.

103. The apparatus of claim 99 wherein the dynamoelectric machine is an alternator.

104. The apparatus of claim 99 wherein the dynamoelectric machine is a generator.

105. A method of making a coil structure for a dynamoelectric machine, comprising:

winding magnet wires in a plurality of slots in a lamination stack to form coils;

molding plastic around the magnet wires at a pressure sufficient to at least partially deform individual magnet wires into at least partial polygonal shapes.

106. The method of claim 105 wherein the at least partial deformation of individual magnet wires into at least partial polygonal shapes increases surface area contact between individual magnet wires to enhance heat transfer from the magnet wires to the thermally conductive plastic.

107. The method of claim 106 wherein the dynamoelectric machine is an electric motor.

108. The method of claim 107 wherein the coil structure is an armature.

109. The method of claim 107 wherein the coil structure is a stator.

110. The method of claim 106 wherein the dynamoelectric machine is an alternator.

111. The method of claim 106 wherein the dynamoelectric machine is a generator.

112. An armature for an electric motor, comprising:

a lamination stack having slots therein;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled;

an insulative sleeve disposed on the armature shaft between the lamination stack and the armature shaft and between the commutator and the armature shaft; and

thermally conductive plastic at least partially encasing the magnet wires.

113. The armature of claim 112 wherein the slots of the lamination stack includes slot liners made of electrically insulative plastic.

114. The armature of claim 113 wherein the electrically insulative plastic is molded in the slots in the lamination stack to form the slot liners and around the armature shaft at ends of the lamination stack to form end spiders.

115. The armature of claim 114 wherein the electrically insulative plastic is also thermally conductive plastic.

116. An armature for an electric motor, comprising:

a lamination stack having slots therein with slot liners formed of thermally conductive and electrically insulative plastic, the lamination stack having end spiders formed of the thermally conductive and electrically insulative plastic;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled;

an insulative sleeve disposed on the armature shaft between the lamination stack and the armature shaft and between the commutator and the armature shaft; and

thermally conductive plastic at least partially encasing the magnet wires.

117. A method for forming an armature for an electric motor, comprising:

placing an electrically insulative sleeve on an armature shaft;

next securing a lamination stack having slots therein on the armature shaft with the insulative sleeve disposed therebetween;

next molding electrically insulative plastic in the slots of the lamination stack to form slot liners and around the ends of the lamination stack to form end spiders;

next securing a commutator on one end of the armature shaft with the insulative sleeve disposed therebetween;

next winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator; and

next molding thermally conductive plastic to at least partially encase the magnet wires in plastic.

118. The method of claim 117 wherein placing the insulative sleeve on the shaft includes applying a ceramic coating to the shaft.

119. The method of claim 117 wherein the electrically insulative plastic is also thermally conductive plastic.

120. An armature for an electric motor, comprising:

a lamination stack having slots therein;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled;

an insulative sleeve disposed on the armature shaft between the lamination stack and the armature shaft and extending to the commutator;

an electrically insulative seal disposed around the insulative sleeve and abutting the commutator to seal any gap between an end of the insulative sleeve and the commutator; and

thermally conductive plastic at least partially encasing the magnet wires.

121. The armature of claim 120 wherein the slots of the lamination stack includes slot liners made of electrically insulative plastic.

122. The armature of claim 121 wherein the electrically insulative plastic is molded in the slots in the lamination stack to form the slot liners and around the armature shaft at ends of the lamination stack to form end spiders.

123. The armature of claim 122 wherein the electrically insulative plastic is also thermally conductive plastic.

124. An armature for an electric motor, comprising:

a lamination stack having slots therein with slot liners formed of thermally conductive and electrically insulative plastic, the lamination stack having end spiders formed of the thermally conductive and electrically insulative plastic;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled;

an insulative sleeve disposed on the armature shaft between the lamination stack and the armature shaft and extending to the commutator;

an electrically insulative seal disposed around the insulative sleeve and abutting the commutator to seal any gap between an end of the insulative sleeve and the commutator; and

thermally conductive plastic at least partially encasing the magnet wires.

125. A method for forming an armature for an electric motor, comprising:

placing an electrically insulative sleeve on armature shaft;

next securing a lamination stack having slots therein on the armature shaft with the insulative sleeve disposed therebetween;

next molding electrically insulative plastic in the slots of the lamination stack to form slot liners and around the ends of the lamination stack to form end spiders;

next securing a commutator on one end of the armature shaft adjacent an end of the insulative sleeve;

next winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator; and

next molding thermally conductive plastic to at least partially encase the magnet wires and preventing any of the thermally conductive plastic from flowing into any gap between the commutator and the insulative sleeve.

126. The method of claim 125 wherein preventing any of the thermally conductive plastic from flowing into any gap between the commutator and the insulative sleeve includes placing an insulative seal around the insulative sleeve and abutting the commutator prior to molding the thermally conductive plastic.

127. The method of claim 125 wherein preventing any of the thermally conductive plastic from flowing into any gap between the commutator and the insulative sleeve includes providing a mold used to mold the thermally conductive plastic with a dam that surrounds the insulative sleeve adjacent the commutator and abuts the commutator.

128. The method of claim 125 wherein placing the insulative sleeve on the shaft includes applying a ceramic coating to the shaft.

129. The method of claim 125 wherein the electrically insulative plastic is also thermally conductive plastic.

130. A method of manufacturing an armature for an electric motor, comprising:

placing a commutator and a lamination stack on an armature shaft;

winding magnet wire in slots in the lamination stacks to form coils;

attaching ends of the magnet wire to the commutator;

molding plastic around the magnet wire and around the shaft of the armature at ends of the lamination stack;

adjusting a spinning inertia of the armature by adjusting at least one of a mass of the plastic molded and a distribution of the plastic molded.

131. The method of claim 130 wherein the mass of plastic molded is adjusted by varying at least one of the density of the plastic molded and the amount of plastic molded.

132. The method of claim 130 wherein adjusting the distribution of the plastic molded includes adjusting the mass of plastic placed at varying distances from an axis of rotation of the armature shaft.

133. The method of claim 130 wherein the plastic is thermally conductive plastic.

134. A method of manufacturing an armature for an electric motor, comprising:

placing a commutator and a lamination stack on an armature shaft;

winding magnet wire in slots in the lamination stacks to form coils;

attaching ends of the magnet wire to the commutator;

molding plastic around the magnet wire and around the shaft of the armature at ends of the lamination stack;

adjusting at least one of a resonant frequency and critical speed of the armature by adjusting at least one of a geometry of the plastic molded, the physical properties of the plastic and the mechanical properties of the plastic.

135. The method of claim 134 wherein adjusting the geometry of the plastic includes molding a sufficient amount of the plastic around the armature shaft to reduce vibration and flexing of the armature shaft.

136. The method of claim 134 wherein adjusting the mechanical properties of the plastic includes adjusting at least one of its tensile modulus and flexural modulus and adjusting the physical properties of the plastic includes adjusting at least one of its density and hardness.

137. The method of claim 134 wherein molding the plastic increases vibration damping of the armature shaft.

138. The method of claim 134 wherein the plastic is thermally conductive plastic.

139. A method of manufacturing an armature for an electric motor, comprising:

placing a commutator and a lamination stack on an armature shaft;

winding magnet wire in slots in the lamination stacks to form coils;

attaching ends of the magnet wire to the commutator; and

molding plastic around the magnet wire and around the shaft of the armature to stiffen the armature and thereby increase the critical speed of the armature.

140. The method of claim 139 wherein the plastic is thermally conductive plastic.

141. A method for forming a given size armature to increase the power of an electric motor using that armature, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator; and

molding plastic to at least partially encase the magnet wires in the plastic;

the magnet wires being larger than smaller magnet wires used in an armature of the given size where the magnet wires are not at least partially encased in plastic, the electric motor using the given size armature having the larger magnet wires having increased power compared to the electric motor using the given size armature having the smaller magnet wires.

142. The method of claim 141 wherein the magnet wires include armature lead wires that extend from the slots to the commutator and molding the plastic includes molding the plastic around the armature lead wires to support them and prevent them from vibrating when the armature rotates during operation.

143. The method of claim 141 wherein the plastic is molded around the magnet wires in the slots to retain them in the slots, the larger magnet wires wound in the slots filling a larger volume of the slot than the smaller magnet wires.

144. The method of claim 143 wherein the magnet wires include armature lead wires that extend from the slots to the commutator and molding the plastic includes molding the plastic around the armature lead wires to support them and prevent them from vibrating when the armature rotates during operation.

145. The method of claim 141 and further including applying pressure to the magnet wires to compress them in the slots.

146. The method of claim 145 wherein applying pressure to the magnet wires includes applying the pressure with the plastic while it is being molded and further including retaining the magnet wires in the slots with molded plastic.

147. The method of claim 145 wherein applying pressure to the magnet wires includes applying the pressure by applying iso-static pressure to the magnet wires before the plastic is molded.

148. The method of claim 147 wherein applying iso-static pressure includes placing the armature with the magnet wires wound in the slots in the lamination stack in a cavity of a fluid bladder and pressurizing the fluid bladder.

149. The method of claim 145 wherein winding magnet wires in the slots includes winding magnet wires having a layer of heat activated adhesive thereon and activating the heat activated adhesive with heat of the plastic during the molding of the plastic.

150. The method of claim 141 wherein the magnet wires include armature lead wires that extend from the slots to the commutator and molding the plastic includes injection molding the plastic around the magnet wires in the slots of the lamination stack, around the armature lead wires and around the ends of the magnet wires where they are secured to the commutator.

151. The method of claim 150 wherein winding magnet wires in the slots includes winding magnet wires having a layer of heat activated adhesive thereon and activating the heat activated adhesive with heat of the plastic during the molding of the plastic.

152. The method of claim 151 and further including applying pressure to the magnet wires to compress them in the slots.

153. The method of claim 152 wherein applying pressure to the magnet wires includes applying the pressure with the plastic while it is being molded and retaining the magnet wires in the slots with molded plastic.

154. The method of claim 152 wherein applying pressure to the magnet wires includes applying iso-static pressure to the magnet wires before the plastic is molded.

155. The method of claim 154 wherein applying iso-static pressure includes placing the armature with the magnet wires wound in the slots in the lamination stack in a cavity of a fluid bladder and pressurizing the fluid bladder.

156. The method of claim 141 wherein the plastic is a thermally conductive plastic.

157. The method of claim 156 wherein the plastic has a base polymer and a thermally conductive additive of at least one of aluminum oxide, boron nitride, and aluminum nitride.

158. A method for forming a given size armature to increase the power of an electric motor using that armature, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator;

molding plastic over the magnet wires to at least partially encase the magnet wires in the plastic; and

retaining a larger volume of magnet wires in the slots with the plastic than in an armature of the given size where the magnet wires are not at least partially encased in plastic, the electric motor using the given size armature having the larger volume of magnet wires having increased power compared to the electric motor using the given size armature having the smaller volume of magnet wires.

159. The method of claim 158 wherein the larger volume of magnet wires includes the same number of turns of larger magnet wires than smaller magnet wires used in the given size armature without the magnet wires at least partially encased in the plastic.

160. The method of claim 159 wherein the magnet wires include armature lead wires that extend from the slots to the commutator and molding the plastic includes molding the plastic over the armature lead wires to support them and prevent them from vibrating when the armature rotates during operation.

161. The method of claim 160 and further including applying pressure to the magnet wires with the plastic while it is being molded to compress the magnet wires in the slots and retaining the magnet wires in the slots with molded plastic.

162. The method of claim 161 wherein winding magnet wires in the slots includes winding magnet wires having a layer of heat activated adhesive thereon and activating the heat activated adhesive with heat of the plastic during the molding of the plastic.

163. The method of claim 162 wherein the plastic is a thermally conductive plastic.

164. The method of claim 163 wherein the plastic has a base polymer and a thermally conductive additive of at least one of aluminum oxide, boron nitride, and aluminum nitride.

165. The method of claim 150 and further including applying iso-static pressure to the magnet wires to compress the magnet wires in the slots before plastic is molded by placing the armature with the magnet wires wound in the slots in a cavity of a fluid bladder and pressurizing the fluid bladder.

166. The method of 165 wherein winding magnet wires in the slots includes winding magnet wires having a layer of heat activated adhesive thereon and activating the heat activated adhesive with heat of the plastic during the molding of the plastic.

167. The method of claim 158 wherein the larger volume of magnet wires include a greater number of turns of magnet wires than in the armature of the given size without the magnet wires at least partially encased in plastic.

168. The method of claim 167 wherein the magnet wires include armature lead wires that extend from the slots to the commutator and molding the plastic includes molding the plastic over the armature lead wires to support them and prevent them vibrating when the armature rotates during operation.

169. The method of claim 168 and further including applying pressure to the magnet wires with the plastic while it is being molded to compress the magnet wires in the slots and retaining the magnet wires in the slots with molded plastic.

170. The method of claim 169 wherein winding magnet wires in the slots includes winding magnet wires having a layer of heat activated adhesive thereon and activating the heat activated adhesive with heat of the plastic during the molding of the plastic.

171. The method of claim 170 wherein the plastic is a thermally conductive plastic.

172. The method of claim 171 wherein the plastic has a base polymer and a thermally conductive additive of at least one of aluminum oxide, boron nitride and aluminum nitride.

173. The method of claim 168 and further including applying iso-static pressure to the magnet wires to compress the magnet wires in the slots before plastic is molded by placing the armature with the magnet wires wound in the slots in a cavity of a fluid bladder and pressurizing the fluid bladder.

174. The method of 173 wherein winding magnet wires in the slots includes winding magnet wires having a layer of heat activated adhesive thereon and activating the heat activated adhesive with heat of the plastic during the molding of the plastic.

175. A method for forming an armature for an electric motor, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator, the magnet wires having armature lead wires that extend from the slots to the commutator; and

molding plastic over the magnet wires to encase at least the armature lead wires in plastic.

176. The method of claim 175 wherein molding the plastic includes molding it over the magnet wires in the slots and over the ends of the magnet wires where they are secured to the commutator.

177. The method of claim 176 wherein the plastic is thermally conductive plastic.

178. The method of claim 177 wherein the plastic has a base polymer and a thermally conductive additive of at least one of aluminum oxide, boron nitride and aluminum nitride.

179. A method for forming an armature for an electric motor, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator, the magnet wires having armature lead wires that extend from the slots to the commutator; and

molding plastic over the magnet wires to retain them in the slots and to support the armature lead wires and prevent them from vibrating when the armature rotates during operation.

180. The method of claim 179 wherein molding the plastic includes molding it over the magnet wires in the slots and over the ends of the magnet wires where they are secured to the commutator.

181. The method of claim 180 wherein the plastic is thermally conductive having a base polymer and a thermally conductive additive of at least one of aluminum oxide, boron nitride, and aluminum nitride.

182. The method of claim 141 wherein the plastic is a thermoplastic and molding the plastic includes injection molding it.

183. The method of claim 141 wherein the plastic is a thermoset and molding the plastic includes one of injection molding, transfer molding and compression molding.

184. The method of claim 158 wherein the plastic is a thermoplastic and molding the plastic includes injection molding it.

185. The method of claim 159 wherein the plastic is a thermoset and molding the plastic includes one of injection molding, transfer molding and compression molding.

186. The method of claim 175 wherein the plastic is a thermoplastic and molding the plastic includes injection molding it.

187. The method of claim 175 wherein the plastic is a thermoset and molding the plastic includes one of injection molding, transfer molding and compression molding.

188. A three plate mold for use in molding plastic around an armature for an electric motor, the armature having a shaft with a lamination stack and an armature affixed to the shaft, the mold comprising:

a core plate;

a cavity plate that closes against the core plate, the cavity plate having a plurality of passages therein with a gate at each end of each passage that opens to a cavity of the mold;

a runner plate that closes against the cavity plate, the runner plate having a shaft opening through which the armature shaft extends when the runner plate is closed against the cavity plate and an armature is in the mold cavity, the runner plate having a ring runner around the shaft opening, the ring runner having openings that open to the passages in the cavity plate when the runner plate is closed against the cavity plate.

189. The mold of claim 188 and further including at least one feature that locates the armature in the mold cavity, each gate when the plates are closed located in spaced relation to an end of the lamination stack and between ends of adjacent slots in the lamination stack so that when plastic flows out of the gates into the mold cavity, it enters the mold cavity in spaced relation to and between ends of adjacent slots in the lamination stack.

190. The mold of claim 189 wherein the cavity plate has a gate for each two slots in the lamination stack with each gate feeding two slots of the lamination stack with plastic.

191. The mold of claim 189 wherein the at least one feature that locates the armature in the mold includes at least one key that projects into one of the slots in the lamination stack.

192. The mold of claim 189 wherein the at least one feature that locates the armature in the mold includes a key for each slot that projects into that slot and extends the length of the slot that it projects into, each key sized to provide thin wall flow regions before an outside diameter of the lamination stack to cause the plastic to start freezing off before it reaches the outside diameter of the lamination stack.

193. The mold of claim 188 wherein the ring runner includes two semi-circular runners that extend around the shaft opening in the top plate on opposite sides thereof.

194. The mold of claim 188 wherein the core plate includes a pressure transducer port opening into the cavity of the mold in proximity to the commutator of the armature when the armature is received in the mold cavity.

195. In a two-plate mold for use in molding plastic around an armature for an electric motor, the improvement comprising the mold having at least one overflow tab cavity.

196. The mold of claim 195 having a mold cavity with the overflow tab cavity coupled to the mold cavity by a gate that opens proximate to the commutator of the armature when the armature is received in the mold cavity.

197. The mold of claim 196 wherein the gate coupling the overflow tab cavity to the mold cavity is sized so that as molding pressure builds up in the mold cavity, the plastic flows into the overflow tab cavity before flashing over the commutator of the armature.

198. The mold of claim 197 wherein the overflow tab cavity includes a plurality of overflow tab cavities, each overflow tab cavity coupled to the mold cavity by a gate that opens proximate to the commutator of the armature.

199. The mold of claim 198 wherein the overflow tab cavities are sized so that when they are full and molding pressure continues to build up in the mold cavity, the plastic has begun to freeze off in the area of the commutator.

200. A three plate mold for use in molding plastic around an armature for an electric motor, the armature having a shaft with a lamination stack and an armature affixed to the shaft, the mold comprising:

a core plate;

a cavity plate that closes against the core plate, the cavity plate having a gate for every two slots in the lamination stack, each gate opening to the mold cavity in spaced relation to an end of the lamination stack and between ends of adjacent slots in the lamination stack so that each gate feeds plastic to two adjacent slots in the lamination stack, the cavity plate further including a drop passage for each gate;

a runner plate that closes against the cavity plate, the runner plate having a shaft opening through which the armature shaft extends when the runner plate is closed against the cavity plate and an armature is in the mold cavity, the runner plate having a runner that extends to a ring runner around the shaft opening, the ring runner having openings that open to the passages in the cavity plate when the runner plate is closed against the cavity plate, the ring runner including two semi-circular runners on opposite sides of the shaft opening, the semi-circular runners having the openings therein;

a key for each slot in the lamination stack, the keys projecting into respective slots in the lamination stack and extending the length of the slots, the keys sized to provide thin wall flow regions before an outside diameter of the lamination stack to cause the plastic to start freezing off before it reaches the outside diameter of the lamination stack.

201. The mold of claim 200 wherein the core plate includes a pressure transducer port opening into the cavity of the mold in proximity to the commutator of the armature when the armature is received in the mold cavity.

202. A two-plate mold for use in molding plastic around an armature for an electric motor, the armature having a shaft with a lamination stack and an armature affixed to the shaft, the improvement comprising the mold having a plurality of overflow tab cavities, each overflow tab cavity coupled to a mold cavity by a gate that opens proximate to the commutator of the armature when the armature is received in the mold cavity, each gate sized so that as molding pressure builds up in the mold cavity, the plastic flows into the overflow tab cavities before flashing over the commutator of the armature.

203. The mold of claim 202 wherein the overflow tab cavities are sized so that when they are full and molding pressure continues to build up in the mold cavity, the plastic has begun to freeze off in the area of the commutator.

204. A method of forming an armature for an electric motor, comprising:

placing a commutator and a lamination stack on an armature shaft;

winding magnet wires in slots in the lamination stack to form coils;

attaching ends of the magnet wires to the commutator;

placing the armature in a cavity of a core plate of a three plate mold in an injection molding machine commutator first;

locating the armature in the mold cavity by keys of the mold that project into the slots, the keys extending the length of the slots;

closing a cavity plate against the core plate and closing a runner plate against the cavity plate, the shaft of the armature extending through the cavity plate and a shaft opening in the runner plate;

injecting thermally conductive plastic into the mold cavity through a ring runner in the runner plate, through drop passages in the cavity plate and through gates at the end of the drop passages that open to the mold cavity, the gates located in spaced relation to and between adjacent slots in the lamination stack so that each gate directs plastic into two adjacent slots in the lamination stack;

freezing off the plastic before it reaches an outside diameter of the lamination stack by a thin wall flow region before the outside diameter of the lamination stack provided by the keys being sized to provide the thin wall flow region.

205. A method of forming an armature for an electric motor, comprising:

placing a commutator and a lamination stack on an armature shaft;

winding magnet wires in slots in the lamination stack to form coils;

attaching ends of the magnet wires to the commutator;

placing the armature in a cavity of a two-plate mold; and

injecting thermally conductive plastic into the mold cavity and having the plastic flow into overflow cavities in the cavity plate of the mold before flashing over the commutator as molding pressure builds up in the mold cavity.

206. The method of claim 205 and further including having the plastic freeze off in the area of the commutator by the time that the overflow tab cavities are full and molding pressure continues to build up in the mold cavity.

207. An armature for an electric motor, comprising:

a lamination stack having slots therein;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled;

plastic at least partially encasing the magnet wires with at least one balancing feature formed from the plastic.

208. The armature of claim 207 wherein the balancing feature includes a layer of the plastic from which plastic can be removed during dynamic balancing of the armature to balance the armature.

209. The armature of claim 208 wherein the layer of plastic includes at least one balancing ring molded adjacent an axial side of the lamination stack.

210. The armature of claim 208 wherein the layer of plastic includes balancing rings molded adjacent axial sides of the lamination stack.

211. The armature of claim 210 wherein the plastic is thermally conductive plastic.

212. The armature of claim 207 wherein the plastic is thermally conductive plastic.

213. The armature of claim 207 wherein the balancing feature includes a member having pockets therein for receiving weights.

214. The armature of claim 207 wherein the balancing feature includes at least one balancing ring molded adjacent an axial side of the lamination stack, the balancing ring including at least one pocket therein for receiving a weight.

215. The armature of claim 212 wherein the balancing ring includes a plurality of pockets therein.

216. The armature of claim 207 wherein the balancing feature includes a plurality of balancing rings molded adjacent axial sides of the lamination stack, the balancing rings including a plurality of pockets therein for receiving weights.

217. The armature of claim 216 wherein the plastic is thermally conductive plastic.

218. An armature for an electric motor, comprising:

lamination stack having slots therein;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled;

plastic at least partially encasing the magnet wires and forming a plurality of balancing rings adjacent axial sides of the lamination stack.

219. The armature of claim 218 wherein the balancing rings include plastic that can be removed during dynamic balancing of the armature to balance it.

220. The armature of claim 218 wherein the balancing rings include a plurality of pockets for receiving weights.

221. A method of forming and balancing an armature, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator;

molding plastic to at least partially encase the magnet wires in the plastic and forming a balancing feature; and

removing plastic from at least one of the balancing rings to balance the armature during dynamic balancing of the armature.

222. A method of forming and balancing an armature, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator;

molding plastic to at least partially encase the magnet wires in the plastic and forming balancing rings adjacent axial sides of the lamination stack; and

removing plastic from at least one of the balancing rings to balance the armature during dynamic balancing of the armature.

223. A method of forming and balancing an armature, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator;

molding plastic to at least partially encase the magnet wires in the plastic and forming a balancing feature having at least one pocket therein; and

placing a weight in the pocket to balance the armature during dynamic balancing of the armature.

224. A method of forming and balancing an armature, comprising:

securing a lamination stack having slots therein on an armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator;

molding plastic to at least partially encase the magnet wires in the plastic and forming balancing rings adjacent axial sides of the lamination stack, the balancing rings having pockets therein; and

placing at least one weight in at least one pocket of at least one of the balancing rings to balance the armature during dynamic balancing of the armature.

225. A method for forming an armature for an electric motor, comprising:

placing an electrically insulative sleeve on an armature shaft;

securing a lamination stack having slots therein on the armature shaft;

securing a commutator on one end of the armature shaft;

winding magnet wires in the slots in the lamination stack and securing ends of the magnet wires to the commutator; and

molding thermally conductive plastic to at least partially encase the magnet wires in plastic, the thermally conductive plastic having a base polymer that is a blend of at least two polymers.

226. The method of claim 225 wherein the base polymer is a blend of at least two of nylon, PPS, PPA and LCP.

227. The method of claim 225 wherein the base polymer is a blend of PPS and at least one of nylon, PPA and LCP.

228. The method of claim 225 wherein the base polymer is a blend of about ninety percent PPS and about ten percent LCP.

229. An armature for an electric motor, comprising:

a lamination stack having slots therein;

an armature shaft extending coaxially through the lamination stack;

a plurality of magnet wires wound in the slots of the lamination stack;

a commutator disposed on the armature shaft to which ends of the magnet wires are electrically coupled; and

thermally conductive plastic at least partially encasing the magnet wires, the thermally conductive plastic having a base polymer that is a blend of at least two polymers.

230. The method of claim 229 wherein the base polymer is a blend of at least two of nylon, PPS, PPA and LCP.

231. The method of claim 229 wherein the base polymer is a blend of PPS and at least one of nylon, PPA and LCP.